MOV Varistor Device: FMOV07-V Series

1. Device Ratings and Characteristics

Part Number	Maximum Continuous Voltage		Varistor Voltage (@1mA)			Maximum Clamping Voltage @Test Current (@8/20μs)		Maximum Energy (@10/1000μs)	Maximum Peak Current (@8/20μs)	Rated Power	Typical Capacitance (@1KHz)
	ACrms(V)	DC(V)	Vn(Vdc)	Min.	Max.	Vc(V)	Ip(A)	(J)	(A)	(W)	(pF)
FMOV07201-V	130	170	200	180	220	355	10	17.5	1800	0.25	200
FMOV07221-V	140	180	220	198	242	380	10	19	1800	0.25	190
FMOV07241-V	150	200	240	216	264	415	10	21	1800	0.25	170
FMOV07271-V	175	225	270	243	297	475	10	24	1800	0.25	150
FMOV07301-V	195	250	300	270	330	505	10	26	1800	0.25	140
FMOV07331-V	215	275	330	297	363	585	10	28	1800	0.25	130
FMOV07361-V	230	300	360	324	396	620	10	32	1800	0.25	130
FMOV07391-V	250	320	390	351	429	675	10	35	1800	0.25	130
FMOV07431-V	275	350	430	387	473	745	10	40	1800	0.25	120
FMOV07471-V	300	385	470	423	517	810	10	42	1800	0.25	100
FMOV07511-V	320	410	510	459	561	878	10	45	1800	0.25	90
FMOV07561-V	350	460	560	504	616	940	10	45	1800	0.25	90
FMOV07621-V	395	510	620	558	682	1050	10	45	1800	0.25	90
FMOV07681-V	420	560	680	612	748	1120	10	48	1800	0.25	80
FMOV07751-V	465	615	750	675	825	1240	10	48	1800	0.25	80
FMOV07781-V	485	640	780	702	858	1290	10	50	1800	0.25	80
FMOV07821-V	510	670	820	738	902	1355	10	50	1800	0.25	70

2. Agency Approvals

Agency	Agency Approvals	Certificate No.
c UL us	UL1449 4th & cUL	VZCA2.E515006 VZCA8.E515006
VDE	IEC 61051-1:2007 IEC 61051-2:1991 IEC 61051-2:1991/AMD1:2009 IEC 61051-2-2:1991 IEC 62368-1:2018/G.8.1 IEC 60950-1:2005/AMD1:2009/AMD2:2013, Annex Q	40053090

3. Max Rating

	FMOV-V Series	Units
Operation Ambient Temperature Range	-40 to +105	℃
Storage Temperature Range	-40 to +125	℃
Insulation Resistance	>1000	MΩ
Typical Response Time	<25	ns

4. Reliability

Characteristics	Standard	Test Conditions	Specifications
Robustness of terminations	IEC 60068-2-21 Test Ua1	F = 10 N (d ≤ 0.8 mm) ,F = 20 N (d = 1 mm)	$\triangle V_{1mA}$ /V_{1mA}≦±10% No visible damage
Solderability	IEC 60068-2-20 Test Ta (Method 1)	T = 235±5°C, d = 2±0.5s	Approximately≧95%
Resistance to soldering heat	IEC 60068-2-20 Test Tb (Method 1A)	T = 260±5°C, d = 10±1s	$\triangle V_{1mA}$ /V_{1mA}≦±5% No visible damage
Shock	IEC 60068-2-27 Test Ea	Pulse shape: half-sine. a = 490 m/s^2, d = 11ms. N = 6 x 3 shocks	$\triangle V_{1mA}$ /V_{1mA}≦±5% No visible damage
Vibration	IEC 60068-2-6 Test Fc Method B4	Frequency range: 10 Hz to 55 Hz ,a = 0.75 mm or 98 m/s^2 (whichever is the less), d = 3x2 h	$\triangle V/_{1mA}$ V_{1mA}≦±5% No visible damage
Needle flame test	IEC 60695-11-5	Severity: Vertical 10 s	Duration of burning: 5 s max.
Voltage under pulse condition	IEC 61051-2	At class current, 8/20 μs,	As specified in specification
Voltage proof	IEC 61051-2	Metal balls method (4.8.1.2) 2500 V, 60 s	No breakdown or flashover
Pulse current - 8/20 μs	IEC 61051-2	8/20 μs, 10 times, Ipeak=0.25*Imax	△V/V≦±10% No visible damage
Pulse current - 10/1000 μs	IEC 61051-2	10/1000 μs, 10 times, Ipeak = 0.0075* Imax	$\triangle V_{1mA}$ /V_{1mA}≦±10% No visible damage
Combination pulse	IEC 62368-1	Additional test: 10 pulses (combination pulse 6KV/3KA), in one direction, 1 per min	$\triangle V_{1mA}$ /V_{1mA}≦±10% No visible damage U ≤ 1.1 $U_{initial}$ Voltage proof: No breakdown or flashover
Rapid change of temperature	IEC 60068-2-14 Test Na	N = 5 cycles, d = 30 min , θA = -40±3°C, θB = 85±2°C	$\triangle V_{1mA}$ /V_{1mA}≦±10% No visible damage
Climatic sequence	IEC 60068-2-2 Test Ba IEC 60068-2-30 Test Db IEC 60068-2-1 Test Aa IEC 60068-2-30 Test Db	Dry heat, Test Ba:16±2h, T = 85±2°C Damp heat, Test Db first cycle :24h, T = 55±2°C Cold, Test Aa :2h, T = -40±3°C Damp heat Test Ba remaining cycles:5 cycle	$\triangle V_{1mA}/V_{1mA}$≦±10% No visible damage R_{ISO}≧100MΩ Voltage proof: No breakdown or flashover
Endurance at upper category temperature	IEC 61051-1 (4.21)	T:max temperature as specified , Duration: 1000 h, Voltage: max. a. c. voltage	△V/V≦±10% No visible damage R_{ISO}≧1000MΩ U ≤ 1,1 $U_{initial}$

NOTE : Specification subject to change without notice.

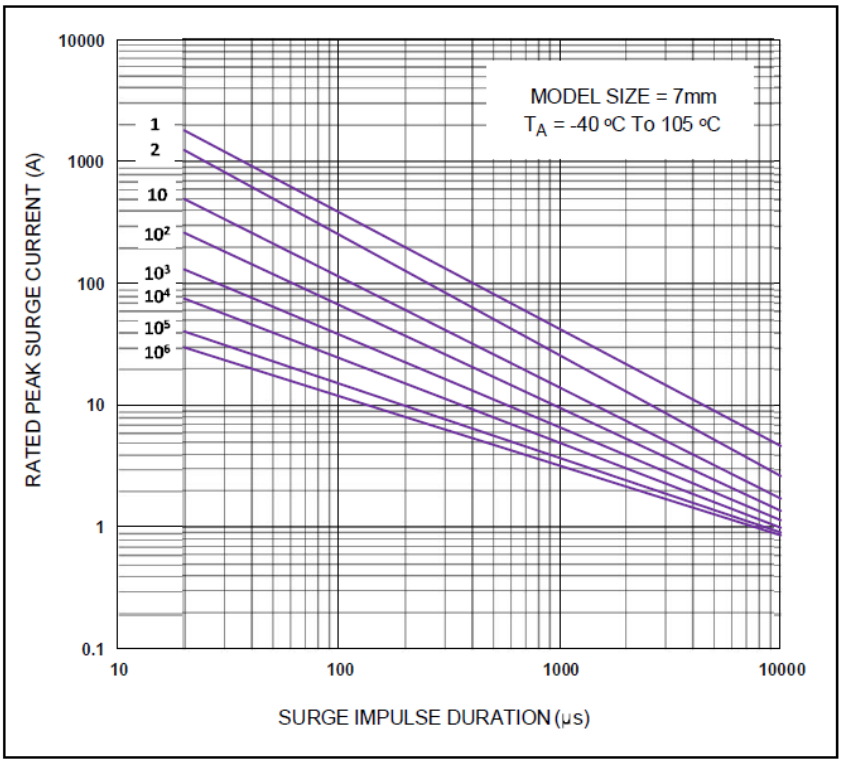
Characteristics	Standard	Test Conditions	Specifications
Damp heat (Steady state)	IEC 60068-2-78 Test Ca	T = 40±2°C, RH = 93(+2/-3)%, 56d , 4 specimens: No voltage applied ,Other 4 specimens: Applied voltage: 10% of the max. d. c. voltage	$\triangle V_{1mA}/V1_{mA} \leqq \pm 10\%$ $R_{ISO} \geqq 100M\Omega$
Maximum Peak Current	Specification Standard	Imax, 8/20 μs, 1 time.	$\triangle V_{1mA}/V1_{mA} \leqq \pm 10\%$ No visible damage
Nominal Discharge Current Test	UL1449 4th	In, 8/20 μs, 15 times, Interval 60s	△V/V≦±10% No visible damage
Varistor Voltage Temp. Coefficient	Specification Standard	$\frac{V_{1mA}\text{ at }85°C - V_{1mA}\text{ at }25°C}{V_{1mA}\text{ at }25°C} \times \frac{1}{60} \times 100(\%/C)$	0.05≦TC≦0.05(%/℃)
High Temperature Storage	IEC60068-2-2	1000h, T = 125±2°C	△V/V≦±5% No visible damage
Max. Energy	Specification Standard	10/1000 μs, 1 times, Max. Energy	△V/V≦±10% No visible damage
Operating duty cycle test ＊	UL1449	6 kV/3 kA combination wave surges, phase angle of 90 (+0, -15) degrees, positive polarity 8times, negative polarity 7 times, interval of 60s.	△V/V≦±10% No visible damage
Surge Immunity Test ＊	IEC 61000-4-5	4kV/2kA combination wave surges, phase angle of 90 (+0, -15) degrees, positive polarity 20times, negative polarity 20times, interval of 60s.	△V/V≦±10% No visible damage

＊ (According to customer requirements to meet the test items)

5. Impulse Life Time Rating Curves

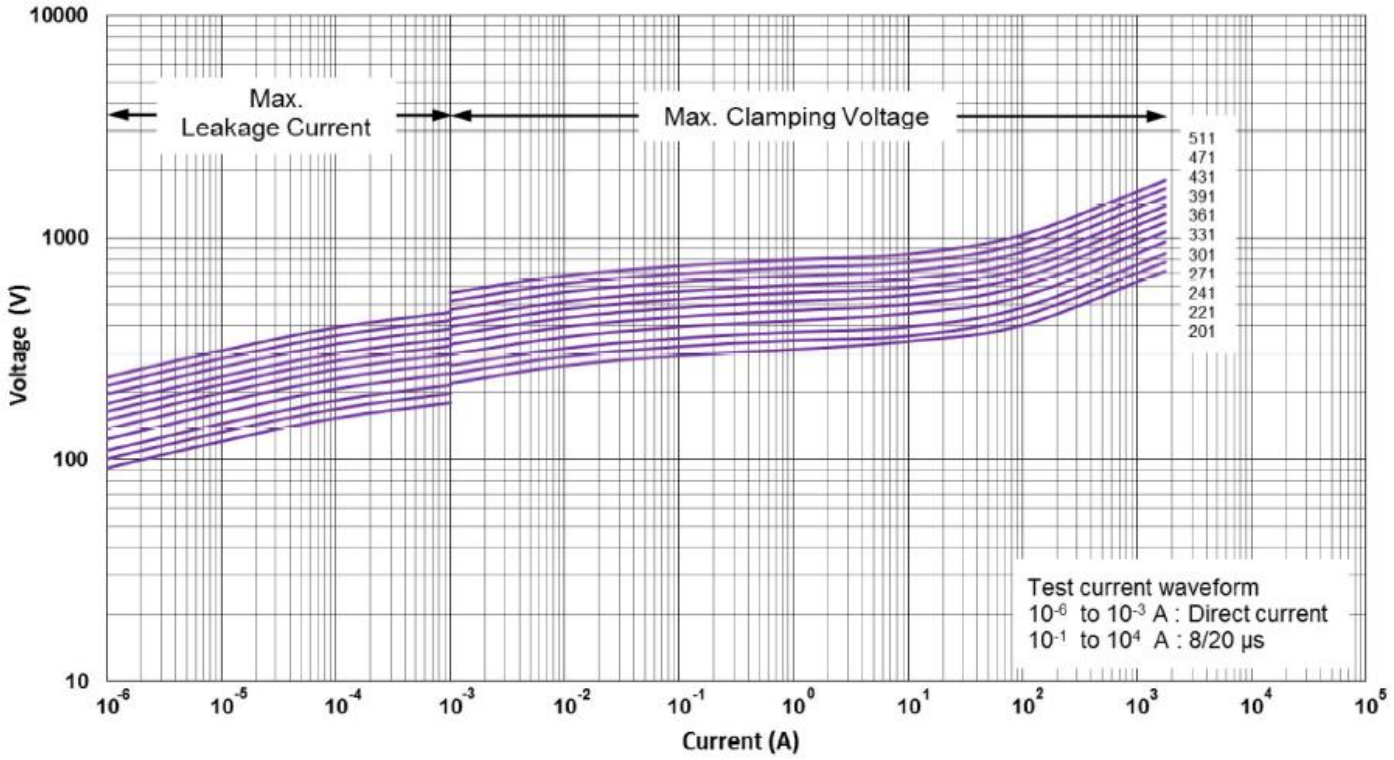
FMOV07-V Series

FMOV07201-V to FMOV07821-V

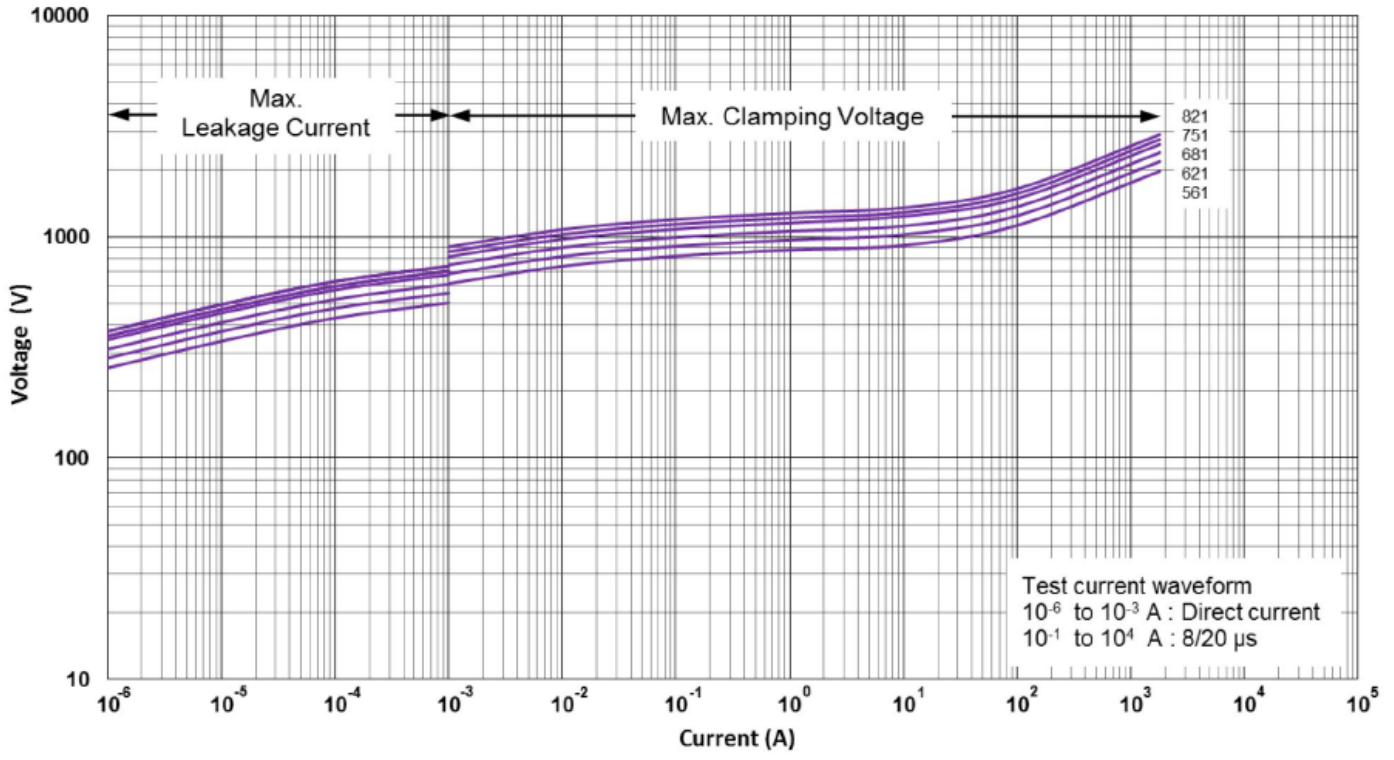


6. V-I Curves

(FMOV07201-V to FMOV07511-V)

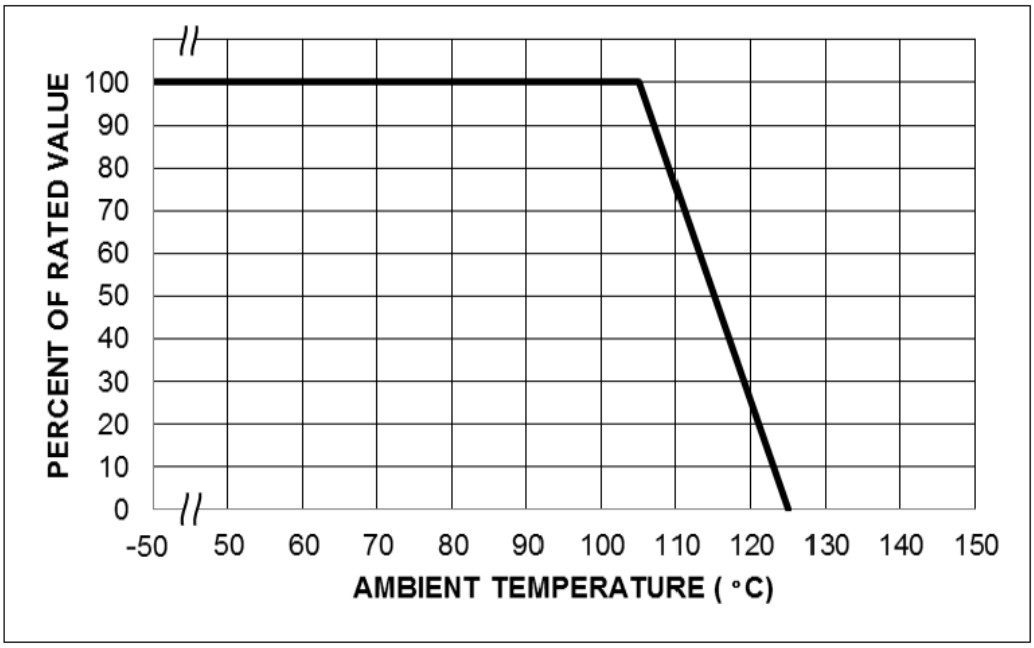


(FMOV07561-V to FMOV07821-V)

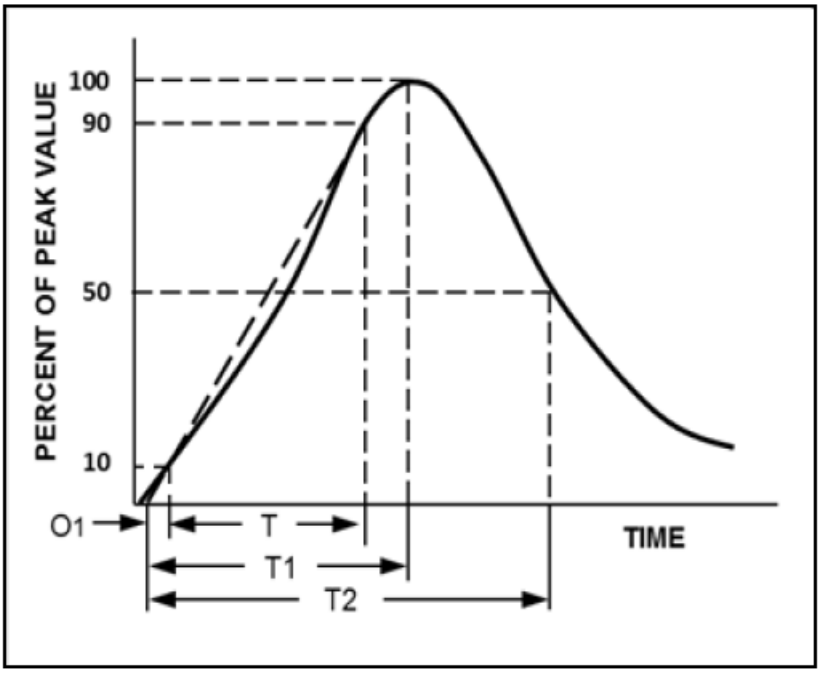


7. Power Derating Curve

Should transients occur in rapid succession, the average power dissipation is the energy (watt-seconds) per pulse times the number of pulses per second. The power so developed must be with the specifications shown on the Device Ratings and Specifications Table for the specific device. The operating values of a MOV need to be derated at high temperatures as shown above. Because varistors only dissipate a relatively small amount of average power they are not suitable for repetitive applications that involve substantial amounts of average power dissipation.



8. Surge Current Standard Waveform



O1 = Virtual Origin of Wave

T = Time from 10% to 90% of Peak

T1 = Rise Time = 1.25 x T

T2 = Decay Time

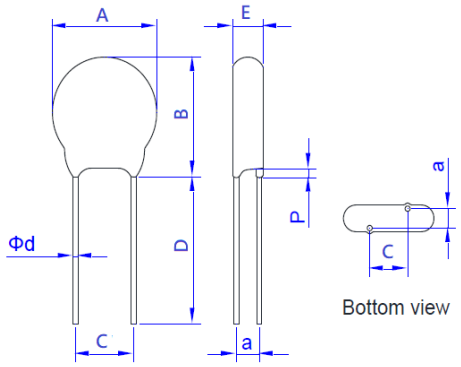
Example - For an 8/20 μs Current Waveform:

8μs = T1 = Rise Time

20μs = T2 = Decay Time

NOTE : Specification subject to change without notice.

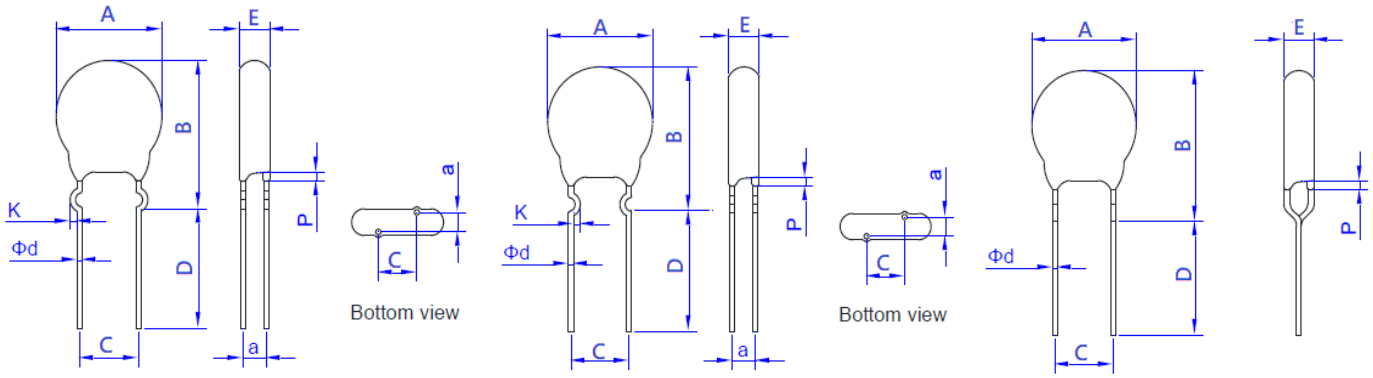
9. Dimension of Component for Standard Product



Straight Lead Type (S)

Part Number	A		B	C	D	E	P	a	Φd
	Min.	Max.	Max.	±1.0	Typ.	Max.	Max.	±1.0	±0.05
FMOV07201-V	7.5	9.0	12.0	5.0	25.0	3.5	3.0	1.5	0.60
FMOV07221-V	7.5	9.0	12.0	5.0	25.0	3.6	3.0	1.6	0.60
FMOV07241-V	7.5	9.0	12.0	5.0	25.0	3.7	3.0	1.7	0.60
FMOV07271-V	7.5	9.0	12.0	5.0	25.0	3.9	3.0	1.8	0.60
FMOV07301-V	7.5	9.0	12.0	5.0	25.0	4.1	3.0	1.9	0.60
FMOV07331-V	7.5	9.0	12.0	5.0	25.0	4.2	3.0	2.0	0.60
FMOV07361-V	7.5	9.0	12.0	5.0	25.0	4.3	3.0	2.1	0.60
FMOV07391-V	7.5	9.0	12.0	5.0	25.0	4.4	3.0	2.3	0.60
FMOV07431-V	7.5	9.0	12.0	5.0	25.0	4.6	3.0	2.4	0.60
FMOV07471-V	7.5	9.0	12.0	5.0	25.0	4.8	3.0	2.5	0.60
FMOV07511-V	7.5	9.0	12.0	5.0	25.0	5.0	3.0	2.6	0.60
FMOV07561-V	7.5	9.0	12.0	5.0	25.0	5.2	3.0	2.8	0.60
FMOV07621-V	7.5	9.0	12.0	5.0	25.0	5.5	3.0	3.1	0.60
FMOV07681-V	7.5	9.0	12.0	5.0	25.0	5.6	3.0	3.3	0.60
FMOV07751-V	7.5	9.0	12.0	5.0	25.0	5.8	3.0	3.6	0.60
FMOV07781-V	7.5	9.0	12.0	5.0	25.0	6.0	3.0	3.8	0.60
FMOV07821-V	7.5	9.0	12.0	5.0	25.0	6.3	3.0	4.0	0.60

Unit: mm



Outside Kink Lead (O) Inside Kink Lead (K) In Line Kink Lead (I)

Part Number	A		B	C	D	E	P	K		a	Φd
	Min.	Max.	Max.	±1.0	Typ.	Max.	Max.	Min.	Max.	±1.0	±0.05
FMOV07201-V	7.5	9.0	15.0	5.0	25.0	3.5	3.0	0.8	1.6	1.5	0.60
FMOV07221-V	7.5	9.0	15.0	5.0	25.0	3.6	3.0	0.8	1.6	1.6	0.60
FMOV07241-V	7.5	9.0	15.0	5.0	25.0	3.7	3.0	0.8	1.6	1.7	0.60
FMOV07271-V	7.5	9.0	15.0	5.0	25.0	3.9	3.0	0.8	1.6	1.8	0.60
FMOV07301-V	7.5	9.0	15.0	5.0	25.0	4.1	3.0	0.8	1.6	1.9	0.60
FMOV07331-V	7.5	9.0	15.0	5.0	25.0	4.2	3.0	0.8	1.6	2.0	0.60
FMOV07361-V	7.5	9.0	15.0	5.0	25.0	4.3	3.0	0.8	1.6	2.1	0.60
FMOV07391-V	7.5	9.0	15.0	5.0	25.0	4.4	3.0	0.8	1.6	2.3	0.60
FMOV07431-V	7.5	9.0	15.0	5.0	25.0	4.6	3.0	0.8	1.6	2.4	0.60
FMOV07471-V	7.5	9.0	15.0	5.0	25.0	4.8	3.0	0.8	1.6	2.5	0.60
FMOV07511-V	7.5	9.0	15.0	5.0	25.0	5.0	3.0	0.8	1.6	2.6	0.60
FMOV07561-V	7.5	9.0	15.0	5.0	25.0	5.2	3.0	0.8	1.6	2.8	0.60
FMOV07621-V	7.5	9.0	15.0	5.0	25.0	5.5	3.0	0.8	1.6	3.1	0.60
FMOV07681-V	7.5	9.0	15.0	5.0	25.0	5.6	3.0	0.8	1.6	3.3	0.60
FMOV07751-V	7.5	9.0	15.0	5.0	25.0	5.8	3.0	0.8	1.6	3.6	0.60
FMOV07781-V	7.5	9.0	15.0	5.0	25.0	6.0	3.0	0.8	1.6	3.8	0.60
FMOV07821-V	7.5	9.0	15.0	5.0	25.0	6.3	3.0	0.8	1.6	4.0	0.60

Unit: mm

NOTE : Specification subject to change without notice.

10. Tape and Reel Specifications

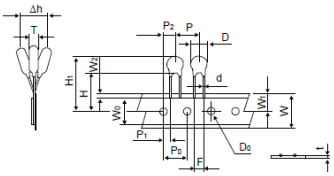


Figure: A

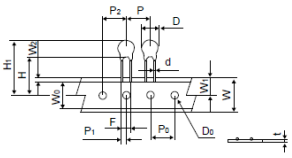


Figure: B

Straight Leads

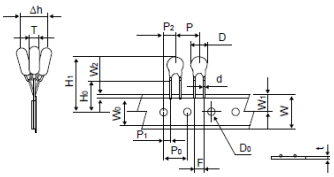


Figure: C

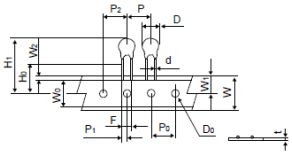


Figure: D

Inline Kink Leads

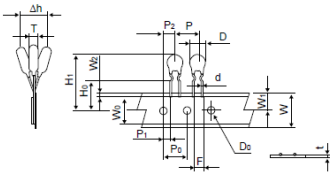


Figure: E

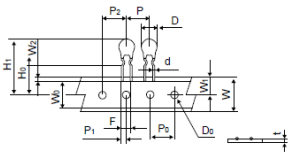


Figure: F

Inside Kink Leads

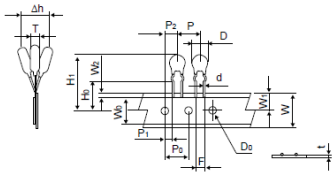


Figure: G

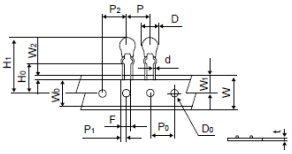


Figure: H

Outside Kink Leads

Symbol	Parameter	FMOV07-V Series
P	Pitch of Component	12.7±1.0
P0	Feed Hole Pitch	12.7±0.2
P1	Feed Hole Center Lead	3.85±0.7
P2	Hole center to Component Center	6.35±0.7
F	Lead to Lead Distance	5.0±0.8
△h	Component Alignment	2.0 Max
W	Tape Width	18.0+1.0 -0.5
W0	Hold Down Tape Width	5.0 Min
W1	Hole Position	9.0+0.75 -0.50
W2	Hold Down Tape Position	3.0 Max
H	Height from Tape Center to Component Base	18.0+2.0 -0
H0	Seating Plane Height	16.0±0.5
H1	Component Height	32.0 Max
D0	Feed Hole Diameter	4.0±0.2
t	Total Tape Thickness	0.7±0.2
L	Length of Clopped Lead	11.0 Max
Figure		ACEG

Unit: mm

NOTE : Specification subject to change without notice.

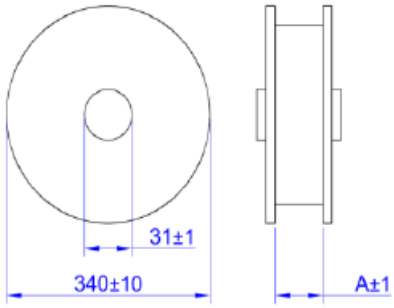
11. Packaging Specifications

Bulk Product Packing

Series	Straight Lead Type Quantity (pcs/bag)	Outside Kink Lead Type Quantity (pcs/bag)	Inside Kink Lead Type Quantity (pcs/bag)	In Line Kink Lead Type Quantity (pcs/bag)
FMOV07-V Series	1000	1000	1000	1000

Tape & Reel Product Packing

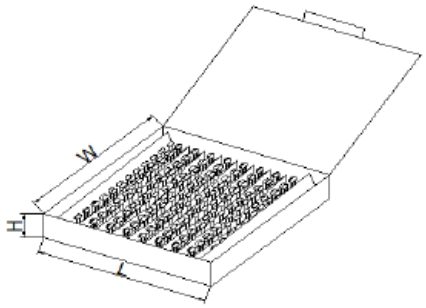
Series	A (mm)	Quantity (pcs/reel)
FMOV07(201~391)-V-T-	43	2000
FMOV07(431~821)-V-T-		1500



Box Product Packing

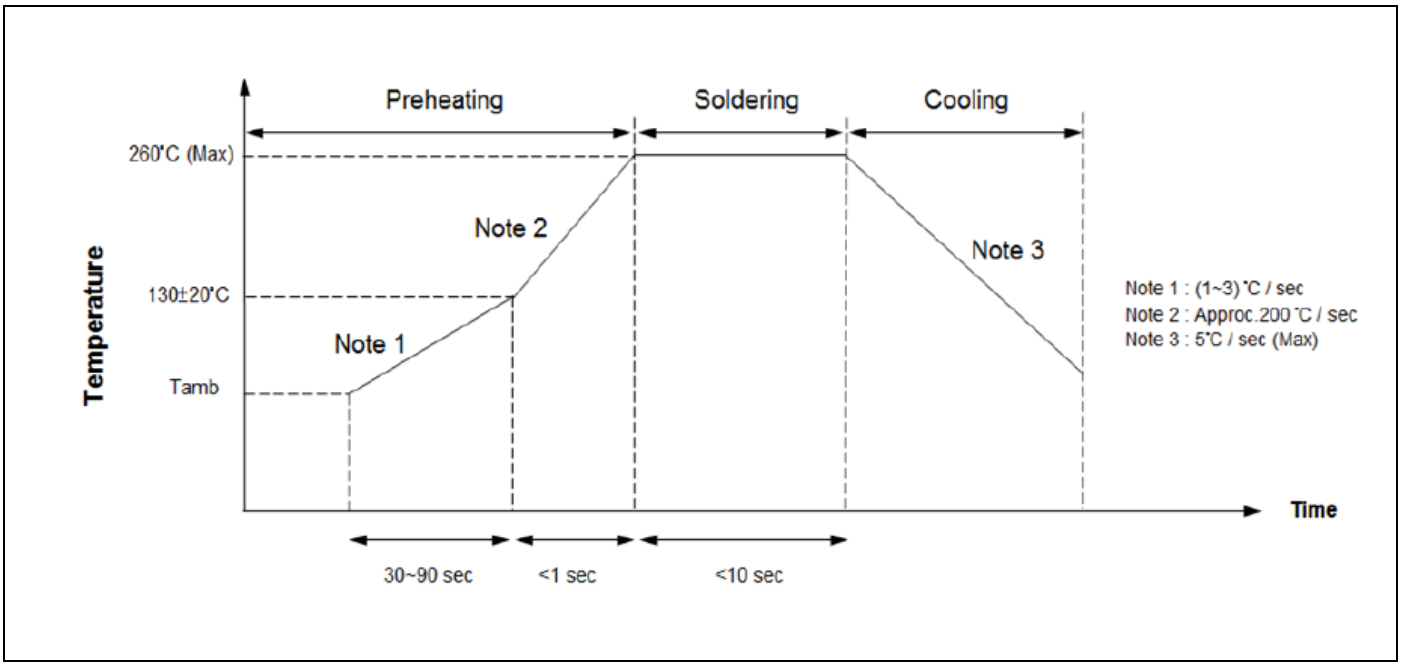
Series	Quantity (pcs/reel)
FMOV07(201~391)-V-A-	1000
FMOV07(431~821)-V-A-	800

Series	L±5	W±5	H±5
FMOV07-V Series	340	245	45



NOTE : Specification subject to change without notice.

12. Solder Recommendation



Recommendation Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of soldering Iron-tip	360℃ (Max)
Soldering Time	3 sec (Max)
Distance from Varistor	2mm (Min)

RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS Directive 2002/95/EC

Storage Conditions of Products

(I) Storage Conditions:

a. Storage Temperature: -10℃~+40℃

b. Relative Humidity: ≦75%RH

c. Keep away from corrosive atmosphere and sunlight

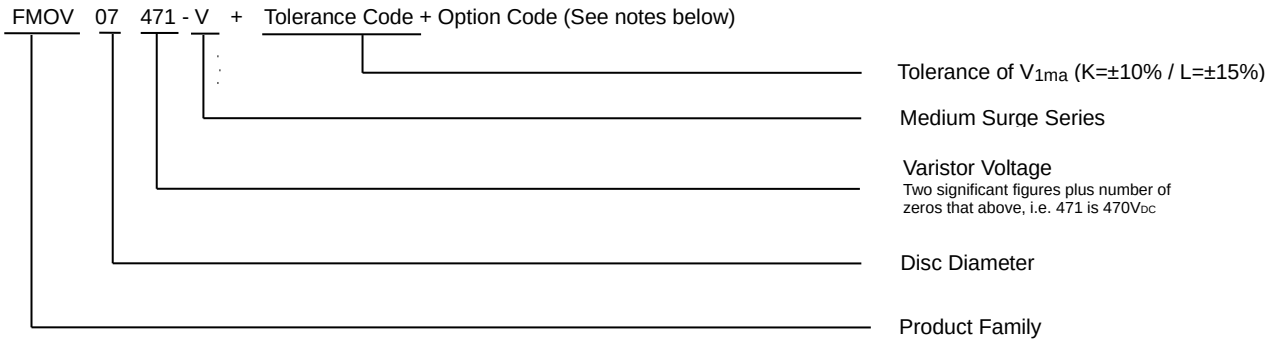
d. Solvent Resistance: MIL–STD–202, Method 215F

e. Moisture Sensitivity: Level 1, J-STD-020

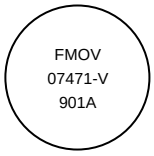
(II) Period of Storage: 1 year

13. Part Numbering and Marking System

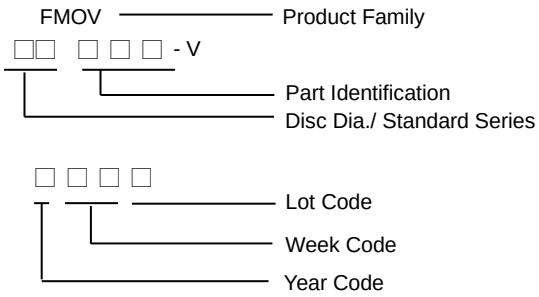
Part Numbering System



Marking System



Example



NOTE : Specification subject to change without notice.

14. Order Notes:

Main Part Code:

Part No + Tolerance Code + Packaging + Lead Type Designators + Option Code

Ordering examples:

Straight Lead Bulk Pack (Standard)	Straight Lead (Short Cut) Bulk Pack	Straight Lead Tape & Reel Pack	Straight Lead Flat Box Pack
FMOV07471-V**KBS**	FMOV07471-V**KBSXXX**	FMOV07471-V**KTS**	FMOV07471-V**KAS**

Tape & Reel Pack Feed Hole Pitch
FMOV07471-V**KTSA**
FMOV07471-V**KTSB**

Outside Kink Lead Bulk Pack	Outside Kink Lead (Short Cut) Bulk Pack	Outside Kink Lead Tape & Reel Pack	Outside Kink Lead Flat Box Pack
FMOV07471-V**KBO**	FMOV07471-V**KBOXXX**	FMOV07471-V**KTO**	FMOV07471-V**KAO**

A: P_0 → 12.7mm±0.2mm

B: P_0 → 15.0mm±0.2mm

Inside Kink Lead Bulk Pack	Inside Kink Lead (Short Cut) Bulk Pack	Inside Kink Lead Tape & Reel Pack	Inside Kink Lead Flat Box Pack
FMOV07471-V**KBK**	FMOV07471-V**KBKXXX**	FMOV07471-V**KTK**	FMOV07471-V**KAK**

In Line Kink Lead Bulk Pack	In Line Kink Lead (Short Cut) Bulk Pack	In Line Kink Lead Tape& Reel Pack	In Line Kink Lead Flat Box Pack
FMOV07471-V**KBI**	FMOV07471-V**KBIXXX**	FMOV07471-V**KTI**	FMOV07471-V**KAI**